

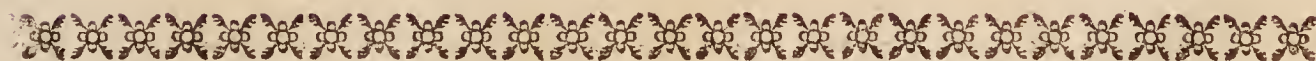


A

DISCOURSE

DELIVERED AT

The ROYAL SOCIETY, Nov. 30, 1773.



13
John Hawkins Junr
Surgeon
Bury St Edmund

A
DISCOURSE

ON THE

Different Kinds of Air,

DELIVERED AT THE

Anniversary Meeting of the ROYAL SOCIETY,

November 30, 1773.

By Sir JOHN PRINGLE Bart. PRESIDENT.

PUBLISHED AT THEIR REQUEST.

LONDON:

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GENTLEMEN,

IT is with great satisfaction I enter upon this part of my office—to confer, in your name, the prize-medal of the present year upon a Member of this Society so worthy of that distinction.

The object which Sir GODFREY COPLEY, founder of the benefaction, had in view, and the manner in which the original pecuniary reward was converted into this more liberal form, having been so lately explained by my
B.
honoured

honoured predecessor; I need only observe, that though your President and Council have been entrusted with the sole power of adjudging this premium, yet they have now, as, I am persuaded, they have had on former occasions, the greatest sollicitude to nominate that person, who in their opinion would have obtained all your suffrages.

In confidence of such unanimity, it is with singular pleasure I acquaint you, that the Reverend JOSEPH PRIESTLEY, Doctor of Laws, has been found at this time the best entitled to so public a mark of your approbation, on account of the many curious and useful experiments contained in his *Observations on different kinds of Air*, read at the Society in March 1772, and inserted in the last complete volume of your Transactions [a]. And indeed, GENTLEMEN, when you reflect on the zeal which our worthy brother has shewn to serve the public and to do credit to your institution, by his numerous, learned, and valuable communications, you will, I imagine, be inclined to think, that we have been rather slow than precipitate in acknowledging so much merit.

[a] Vol. 62.

Your

Your time will not allow me to touch on the subjects of his former Papers [b]; nay I apprehend I shall even trespass upon it, by recalling to your memory only a few of those interesting discoveries which Doctor PRIESTLEY has made in these *Observations*: since in doing justice to others, as well as to him, it will be proper to remind you of the progress that had already been made in this part of science by men of the greatest abilities in their time, and by other ingenious persons still among us.

THERE is not perhaps any branch of Natural Philosophy that has more engaged the attention of the learned, or been more successfully cultivated, than the nature of the common air. The knowledge how indispensable it is to the preservation of animals, must have been coeval with mankind: it was from the beginning, as now, *the breath of life*. It was found likewise to be a necessary support of fire, and that the vegetable creation, deprived of it, languished and died. Nor did the ancient physicians fail to distinguish, at least attempt to

[b] In Phil. Trans. vol. 58, 59, 60.

distinguish, between the effects of an air too hot and one too cold, an air too moist and one too dry, and between an insalutary and a wholesome air.—Thus far the experience, or the theory of all ages.—But the less obvious properties of this element, its gravitation and its elasticity, with their long train of consequences, remained unknown, till, about the beginning of the last century, Lord BACON and GALILEO, in that dawn of philosophy which they themselves diffused, began the inquiry. The former from experiments ascertained the elasticity of the air, and upon that principle constructed his *vitrum calendare*, the first thermometer [c]. The latter discovered that air had weight: but though that ornament of Italy was not ignorant of the limited suction of a pump, yet to account for the rise of the water so far in it, he still had recourse to Nature's *abhorrence of a void* [d].

TORRICELLI, at last, the disciple of GALILEO, by one happy and decisive experiment discovered the pressure of the atmosphere; and PASCAL observed, that this pressure varied according to the heights he carried his barome-

[c] Bac. Nov. Org. lib. 2. aph. 13.

[d] Dialog. 1.

ter [e]. Soon after followed the air-pump, the invention of the celebrated OTTO DE GUERICK; which though at first a rude and imperfect instrument, yet improved by himself [f], and more by Mr. BOYLE and Dr. HOOK (two of the illustrious fathers of this Society) it soon became in the hands of Mr. BOYLE the means of opening the richest mines of natural knowledge. In this research, the History of the common air, he seemed so far to carry his inquiries, as to leave little to be done by others who should come after him; those parts excepted depending on geometry and calculation [g]. How successfully these were executed by Dr. HALLEY and Sir ISAAC NEWTON, I scarce need mention; nor the solid foundation on which those great men established the rarefaction of the air; and in what proportion, according to its distance from the earth [h]. But it was

[e] Traité sur l'Equilibre des Liq.

[f] Gaspar. Schott. De Arte Mechan. Hydr. Pneumat. Exp. nova Magdeburg.

[g] Boyle, Physico-mechan. Exp. & Mem. for a Gen. Hist. of the Air.

[h] Phil. Transf. N^o 181. p. 104. Abrid. vol. 2. p. 14. Phil. Nat. Princ. Math. lib. 2. prop. 22, 23.

Sir ISAAC NEWTON alone, who, upon the principle of the air's being compressed by the power of gravity, and that of its elasticity, taught that tremulous bodies would communicate their motion to the air, and thereby excite vibrations in it, spreading every where. Thus he discovered the efficient cause of sounds [i].

But before this period Mr. BOYLE observing, as he himself informs us, how much air was concerned in many of the *phænomena* of Nature, and how necessary it was to the existence of animals, became solicitous to inquire, whether a fluid of so great importance were not produceable by art; if so, he believed that such air might be serviceable in life, particularly in the art of diving, and in *submarine navigation* [k]. With these views that admirable Naturalist set about making some new experiments, and from a variety of bodies, by different processes, obtained a pneumatical fluid (from ripe fruit, fermenting and effervescent liquors, and from the putrefaction

[i] Phil. Nat. Princ. Mat. lib. 2. prop. 43.

[k] An attempt of Cornelius Drebell to make a vessel to row under water with men in it. See Boyle's works, vol. 1. p. 69. vol. 3. p. 174.

of animal and vegetable substances) answering, till then, his only criterion of air, in being of a durably elastic nature [1]. Yet after all, Mr. BOYLE found that these new productions were essentially different from common air, as they presently extinguished flame, and suffocated those animals that attempted to breathe in them. But though he missed finding what he so much wanted, his labour was not in vain; philosophy was enriched with the knowledge of what he called *factitious* or *artificial* air, which has in the end proved as useful as he could have wished, in explaining several natural appearances, and in being subservient to the wants of man.

But this discovery, however interesting to the Naturalist, to the Chemist in particular [m], seems to have been little attended to, till in the beginning of this century Sir ISAAC NEWTON observed, that true permanent air arises from fixed bodies by heat and fermentation; and that those aërial particles recede from one another with the greatest force, which upon contact cohered most strongly:—and that dense bodies

[1] Boyle's Works, vol. 4. p. 236, & seq.

[m] Hales, Stat. Eff. vol. 1. ch. 6. p. 317.

by fermentation rarefy into several sorts of air ; and that this air by fermentation, and sometimes without it, returns into dense bodies [n]. Excited by such authority, the Reverend Doctor HALES (whose amiable as well as philosophic qualities are still fresh on the minds of several gentlemen present) resuming those experiments concerning the separation of air from bodies, confirmed and extended the discoveries of Mr. BOYLE ; shewing not only that air entered into the composition of most bodies, but the very proportion it bore to the rest of the compound, and that often to an amazing quantity [o]. Dr. HALES likewise examined the mineral waters, those of Pyrmont particularly ; and finding them abounding with air, to that circumstance he ascribed the spirit and briskness of those fountains. But that excellent author did not seem to apprehend, that in this, as in other instances, the air which he produced was not the common air, but, if I may be allowed the expression, the *factitious* air of Nature ; as being of the same kind with what Mr. BOYLE had extracted.

[n] Compare Newton's Optics, Quer. 30, 31.

[o] Stat. Ess. vol. 1. ch. 6.

from fermenting and effervescing liquors; nay the same with the *mephitis* or deadly vapour of the ancients, or the *mosfeta* of the modern Italians, so frequently met with in the caverns, springs, and lakes of their country: and the same with the *stith* or *choak-damp* in our coal-pits, so often fatal to the miners. It must be owned it was hard to conceive, how these springs should owe their prime virtues to what, in another manner of application, Dr. HALEs saw was so destructive of vitality.

Now this notion concerning the impregnation of the mineral waters by the *mephitis*, was, as far as I know, originally suggested by a foreign Member, Dr. SEIP of Pyrmont, first in a treatise he published in the German language, and afterwards in a communication to this Society, in the year 1736, in which he describes a small cavern at Pyrmont, similar to the *grotta de' cani*, near Naples [*p*]. But when this ingenious author calls that *mephitis* (which is a durably elastic fluid *sui generis*) a *sulphureous steam*, or a *sulphureo-spirituuous vapour*, he appears to have been imper-

[*p*] Phil. Trans. N^o 448. Abridg. vol. 8. p. 659.

fectly acquainted with its nature; which is now found to consist of nothing inflammable or sulphureous, and to be of a density or specific gravity considerably greater than that of common air.

Thus the fuller discovery of this principle we owe to Dr. BROWNRIGG of White-haven, who, about thirty years ago, began clearly to unfold this mystery. But those curious papers were not then inserted in the Transactions, as the too modest author had requested a delay, till he should be able to make them more worthy of that honour. In that communication he remarks, “ That a more intimate acquaintance with those noxious airs in mines, called *damps*, might lead to the discovery of that subtle principle of mineral waters, known by the name of their *spirit*; that the mephitic exhalations, termed the *choak-damp*, he had found to be a fluid permanently elastic; and from various experiments he had reason to conclude that it entered the composition of the waters of Pyrmont, Spa, and others; imparting to them that pungent taste, from which they were denominated *acidulae*, and likewise that volatile principle,

principle, on which their virtues chiefly depend [q].”

In order to ascertain a fact of so much consequence, Dr. BROWNRIGG took the opportunity, when at Spa several years after, to make some experiments for this purpose; when he had the satisfaction to find those waters pregnant with the *artificial* or *factitious* air of Mr. BOYLE, the same with that of the suffocating *grotta* near Naples, and the same with the *choak-damp* of our coal mines; for as much as this air instantly extinguished flame, and the life of those animals he had inclosed in it [r]. The success of this worthy member, in thus far analyzing those waters, encouraged others to pursue the inquiry; and to investigate the manner in which Nature also furnished them with the chalybeate principle [s]. Mr. LANE therefore, in consequence of a conversation with Dr. WATSON junior (both of this Society) upon an experiment of Mr. CAVENDISH's, by which that gentleman had found the mephitic air (such as Dr. BROWNRIGG had detected in Spa-water).

[q] Vid. Phil. Transf. vol. 55. p. 236. & seq.

[r] Ib. p. 218. & seq.

[s] More properly, the *iron-principle*.

sufficient to dissolve any calcarious earth [*t*]: in consequence, I say, of this conversation, wherein it was surmised, that the same mephitic air might likewise dissolve iron in common water, he made the experiment with air taken from Spa water, and happily succeeded [*u*]. By this means the nature of the metallic principle in mineral waters was clearly explained; and the whole analysis of those celebrated fountains, so often attempted by Chemists and others, and still eluding their laboured researches, was thus in the most simple manner brought to light.

Nothing now seemed to be wanting to the triumph of Art, but an easy manner of joining, as there should be occasion, one or both of these principles to common water; in order to improve upon Nature, in the more extensive use of her medicine. This was effected by Dr. PRIESTLEY, after some other important discoveries had been made in this part of pneumatics, first by Dr. BLACK, Professor of Chemistry at Edinburgh, and then by Mr.

[*t*] Phil. Transf. vol. 57. p. 92. & seq.

[*u*] Ib. vol. 59. p. 216. & seq.

CAVENDISH of this Society. The former has shewn that a particular species of factitious air (he calls it *fixed*) adheres to all calcarious earths, magnesia, and alkaline salts, with different degrees of force; and that this fluid can be separated from these substances, and combined again with them, in the same manner as an acid. Upon this discovery he explained in a clear and simple manner many appearances in Chemistry, till then deemed the most unaccountable. Such was the effervescence of absorbent earths and alkaline salts with acids, and the change of the mild calcarious earths into quick lime by heat (in consequence of the expulsion of this *fixed* air which neutralizes them) [*w*]. I must add, that I have been well informed, that for several years past the learned Professor has taught, that the air which unites with alkaline substances is of the same nature with the *mephitic*, or suffocating air of the *grotta de' cani* and mines; the same with what is emitted from vegetables in fermentation; and that in some respects it agrees with the air which

[*w*] Eff. and Observ. Phys. & Liter. vol. 2. p. 157. & seq.
has

has been injured by the breath of animals, or by the burning of fuel: and lastly, that the air or elastic fluid arising from the solution of metals by acids is very different from the former.

Mr. CAVENDISH has made several valuable additions to these discoveries, not only with regard to that species of *factitious* air the Professor had denominated *fixed air*, but to other elastic fluids. He has with accuracy ascertained the specific gravity of this fixed air, as expelled from alkaline substances by acids, or from vegetable matter by fermentation; and has demonstrated the similarity of airs produced by either of these two ways. He has confirmed Dr. BLACK's account of the quantity of the fixed air contained in alkaline salts and in alkaline earths. He has shewn that this fluid can be mixed with water, and in what proportion; and that it flies off again from the water upon heating it, or exposing it to the common air. Lastly, that this species of factitious air imparts to the water the power of dissolving absorbent earths; the experiment, as I observed before, which led to the knowledge,

ledge, how Nature infused the metallic principle into what are commonly called the *chalybeate waters* [*x*].

Of all these facts Dr. PRIESTLEY has carefully availed himself. For having learned from Dr. BLACK that this fixed or mephitic air could in great abundance be procured from chalk, by means of diluted spirit of vitriol [*y*]; from Dr. MACBRIDE, that this fluid was of a considerable antiseptic nature [*z*]; from Mr. CAVENDISH, that it could in a large quantity be absorbed by water [*a*]; and from Dr. BROWNRIGG, that it was this very air which gave the briskness and chief virtues to the Spa and Pyrmont waters [*b*]: Dr. PRIESTLEY, I say, so well instructed, conceived that common water impregnated with this fluid alone might be useful in medicine, particularly for Sailors on long voyages, for curing or preventing the Sea-scurvy. This, we know, is a putrid distemper requiring all the antiseptic quality

[*x*] Phil. Transf. vol. 56. p. 141. & seq.

[*y*] Eff. and Observ. Phys. & Liter. loc. cit.

[*z*] Experim. Eff. *passim*.

[*a*] Phil. Transf. vol. 56. p. 161. & seq.

[*b*] Phil. Transf. vol. 55. p. 218. & seq.

of those mineral waters, without the chalybeate principle, which might injure by overheating the blood, too much disposed to inflammation. For this purpose he made a simple apparatus for generating this species of air from chalk and mixing it with water, in such quantities, and in so speedy a manner, that having exhibited the experiment before this Society and the College of Physicians, it met with so much approbation, that, in order the Public might the sooner reap the benefit of it, he was induced to detach this part of his labours, and in a separate Paper to present it to the Admiralty [c].

The rest of his observations upon the different kinds of air, addressed to the Society [d], contain so much matter, that I will not presume to encroach so far on your time, as to offer even a short abstract of the whole; but shall be satisfied to single out a few of those many discoveries, such as are the most striking, either for their immediate use in life, like that above; or for the explanation

[c] A pamphlet intituled Directions for impregnating water, &c.

[d] Phil. Trans. Vol. 62.

of some of the more interesting appearances in Nature.

I come therefore to another species of *factitious* air, called the *inflammable*. Till within these few years little more was known, than that this kind of subtile fluid was found in mines, in neglected privies and common sewers; but chiefly in coal-pits, where it is called the *fire-damp*, making sometimes formidable explosions, and indeed often fatal to the miners. I do not recollect that Mr. BOYLE has taken any other notice of it [*e*]. But about 40 years ago Sir JAMES LOWTHER Baronet, favoured the Society with an account somewhat more particular of this production of his coal-mines in Cumberland, accompanying it with several bladders filled with that fluid, which in this house burnt as readily, as at its source a month before. Yet still this extraordinary substance was considered more as an object of curiosity, than as one of philosophical inquiry, till Mr. CAVENDISH began to make experiments upon

[*e*] Boyle's Works, vol. 3. p. 101. vol. 5. p. 305, 306.

it; by which, and the consequences drawn from them, he has added another considerable branch to the doctrine of aërial fluids.

First, he has taught how to produce at will, and in great abundance, this other permanently elastic fluid from three metallic bodies, Zinc, Iron, and Tin, by dissolving them in the diluted vitriolic acid, or spirit of sea-salt. This species of factitious air he has shewn to be surprizingly light, being no more than the tenth part of the weight of common air, and therefore totally different from the *mephitic*, that other species of factitious air we have been treating of, and which, as was observed, is heavier than the air of our atmosphere. Lastly, Mr. CAVENDISH has given several experiments upon the inflammability of various mixtures of this fluid with common air, which are likewise new; and, like the rest, have been made with great precision.

Now, though Dr. PRIESTLEY has also improved upon this inquiry, by the addition of a variety of experiments; in particular, by shewing how this air becomes miscible with water, and deprived of its inflammability; by comparing

paring it with other species of factitious air, in regard to conducting the electrical fluid; by inquiring how far it may be considered as common air loaded with the principle of fire, called *phlogiston* by the modern Chemists; with other curious observations on this substance: yet all these, with other kinds of factitious air, as I have already too long detained you, I must with regret pass over; one other species excepted, as I reckon it among the most brilliant of Dr. PRIESTLEY'S discoveries [*f*].

This species he calls the *nitrous air*, without insisting on the propriety of the expression. It was first produced from the Walton pyrites by means of the spirit of nitre. Dr. HALES, who made the experiment, observed, that when joined to common air, an effer-

[*f*] I might have added another new species of factitious air, which he terms *acid*, first taken notice of by Mr. CAVENDISH, and more fully investigated by Dr. PRIESTLEY. This is an elastic vapour expelled by heat from spirit of salt, and not liable afterwards to be condensed by cold. Water readily imbibes this air, and by that means becomes a strong spirit of salt. The same acid air or vapour, he has also discovered to be a decomposer of substances that contain *phlogiston*, and with them to form a proper inflammable air.

vescence ensued, with a turbid red colour of the mixture, and an absorption of part of the common air [g]. Dr. PRIESTLEY extending the experiment to other metallic substances observed, that the same kind of air was by the same acid readily procured from iron, copper, brass, tin, silver, quicksilver, bismuth, and nihil; and that though it constantly, when joined to common air, exhibited those appearances mentioned by Dr. HALES, and more conspicuously in proportion to the purity of the common air mixed with it (that is, its fitness for respiration); yet it made no change with either fixed or inflammable air, or that air tainted by the breath of animals, or the corruption of their bodies. By means of this test he was enabled to judge of the kind, as well as of the degree of injury, done to common air by candles burning in it; and to perceive a real difference in the air of his study, after a few persons had been with him there. Nay, a phial of air having been sent him from the neighbourhood of a large town, it appeared upon a comparative trial

[g] Stat. Ess. vol. 2. p. 280.

to be inferior in quality to that taken up near Leeds, where he then resided. It was upon such a prospect of obtaining a criterion for distinguishing good air from bad, that Lord BACON almost in a rapture breaks out: "These are noble experiments that can make this discovery; for they serve for a natural divination of seasons!" and again, "They teach men to choose their dwelling for their better health [*b*]."

Nor is this all the use of the nitrous air; Dr. PRIESTLEY shews it to be one of the strongest antiseptics. The fixed air has been proved by Dr. MACBRIDE, as was remarked, to be powerful in this particular; but this species of factitious air has been found to be of superior efficacy. And as our author has discovered it to be miscible with water, he has reason to believe it may be applied to various purposes, such as the preservation of the more delicate birds, fishes, fruits, and anatomical preparations.

I shall now conclude with shewing from Dr. PRIESTLEY, what resources Nature has

[*b*] Nat. Hist. Exp. 777.

in store against the bad effects of corrupted air, which from various causes infect our atmosphere.

It is well known that flame cannot long subsist without a renewal of common air. The quantity of that fluid which even a small flame requires is surprizing: an ordinary candle *consumes*, as it is called, about a gallon of air in a minute. Now, considering the vast consumption of this vital fluid by fires of all kinds made by man, and by volcanos, it becomes an interesting inquiry, to ascertain what change is made in the air by flame; and to discover what provision there is in Nature, to repair the injury done by this means to our atmosphere. Dr. PRIESTLEY, after relating the conjectures of others, and not finding them satisfactory, was fortunate in falling upon a method of restoring air, which had been vitiated by the burning of candles in it. This led the way to the discovery of one of the great restoratives which Nature employs for this purpose; to wit, vegetation: see by what induction he proves his opinion.

It

It was natural to imagine, that since the change of common air is necessary to vegetable, as well as to animal life, both plants and animals rendered it foul in the same manner, so as to become unfit for further life and vegetation. But when with that expectation the Doctor had put a sprig of mint, in a growing and vigorous state, under an inverted glass-jar standing in water, he was agreeably disappointed to find, that this plant not only continued to live, though in a languishing way, for two months, but that the confined air was so little corrupted by what had issued from the mint, that it would neither extinguish a candle, nor kill a small animal which he conveyed into it. What further evinced the salutary nature of the *effluvia* of vegetables; he found, that air vitiated by a candle left in it till it burnt out, was perfectly restored to its quality of supporting flame, after another sprig of mint had for some time vegetated in it. And to shew that the aromatic vapour of that plant had no share in restoring this purity to the air, he observed, that vegetables of an offensive smell, and even such as scarce had any smell

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at all, but were of a quick growth, proved the very best for this purpose. Nay more, the virtue of growing vegetables was found to be an antidote to the baneful quality of air corrupted by animal respiration and putrefaction.

We have said, that neither candles will burn nor animals live beyond a certain time in a given quantity of air; yet the cause of either so speedy a death or extinction was unknown; nor was any method discovered for rendering that empoisoned air fit again for respiration. Some provision however there must be in Nature for this purpose, as well as for that of supporting flame: without such the whole atmosphere would in time become unfit for animal life, and the race of men as well as beasts would die of a pestilential distemper. Yet we have reason to believe, that in our day the air is not less proper for breathing in, than it was above two thousand years ago; that is, as far as we go back in Natural History. Now, for this important end, the Doctor has suggested, to the Divine as well as to the Philosopher, two grand resources.

resources of Nature: the vegetable creation again is one, and the sea and other great bodies of water are the other.

As to the former, having found that plants wonderfully thrive in putrid air, he began to attempt by means of growing vegetables to purify air that had been injured by animal respiration and putrefaction; nor was he less successful than before. These plants were sure to recover the air to a degree of fitness for breathing in it, and that in proportion to their vigour, and the care he took to remove the rotten leaves and branches; which remaining would have marred the operation.

And with regard to the second resource of Nature, namely the ocean and other waters, Dr. PRIESTLEY having observed, that both the air corrupted by the breath of animals, and that vitiated by other putrid matter, was in a good measure sweetened by the septic part infusing itself into water, he concluded, that the sea, the great lakes and rivers, which cover so large a proportion of the globe, must be highly useful, by absorbing what is putrid, for the further purification of the atmosphere:

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thus

thus bestowing what would be noxious to man and other animals, upon the formation of marine and other aquatic plants, or upon other purposes yet unknown.

From these discoveries we are assured, that no vegetable grows in vain, but that from the oak of the forest to the grass of the field, every individual plant is serviceable to mankind; if not always distinguished by some private virtue, yet making a part of the whole which cleanses and purifies our atmosphere. In this the fragrant rose and deadly nightshade co-operate: nor is the herbage, nor the woods that flourish in the most remote and unpeopled regions unprofitable to us, nor we to them; considering how constantly the winds convey to them our vitiated air, for our relief, and for their nourishment. And if ever these salutary gales rise to storms and hurricanes, let us still trace and revere the ways of a beneficent Being; who not fortuitously but with design, not in wrath but in mercy, thus shakes the waters and the air together, to bury in the deep those putrid and pestilential *effluvia*, which the vegetables upon the
face

face of the earth had been insufficient to consume.

THIS, GENTLEMEN, is what I had to say upon the occasion: perhaps too much; but the fruitfulness of the subject, with my earnest desire of commemorating some of the more important experiments and conclusions of Dr. PRIESTLEY, and of those who preceded him in these inquiries, will, I hope, plead my excuse. Nor can I conclude without congratulating this illustrious Body on the possession of so many members and friends, so capable to promote the great ends of this institution; and who have within these few years so eminently distinguished themselves, by the lights they have thrown, not only upon this, but upon other of the more subtile fluids of Nature. You will understand, that to these discoveries upon factitious air, I join those amazing ones upon magnetism and electricity, with all the uses resulting from them. Here you will recollect the prediction of him, who best taught the method of investigating philosophical truth, the incomparable Lord BACON,

who, with that spirit of divination peculiar to exalted genius, assured his disciples, that when men should cease to trifle in framing *hypotheses*, and building hasty systems; and should by a proper induction from sober and severe experiments attain to the knowledge of the *forms* of things [their more intimate qualities and laws] they should in the end command Nature, and perform works as much greater than were supposed practicable by the powers of natural magic, as the real actions of a *Cæsar* surpassed the fictitious ones of the hero of a romance [*i*]. Some Earnest, nor that inconsiderable, of this magnificent promise this Society has already obtained. Let those who doubt, view that Needle, which, untouched by any loadstone, directs the course of the British mariner round the world; or that apparatus, so perfectly imitating the long supposed inimitable lightning; or that other, which disarms the clouds of that tremendous meteor: or (not to depart from my subject) let them see how Art can

[*i*] Compare Bac. De Dignit. et Augment. Scient. lib 3. cap. 5.

from chalk only, the least promising substance, generate, call it unfetter a copious elastic fluid imprisoned in it, the poison of man, or his medicine, according to the mode of application; which, though invifible, yet diffolves earth and metals, and imparts the fpirit and virtue to the moft prized of mineral waters. Yet thefe are but inventions of yesterday: I would ftrictly fay, inventions within the memory of my youngeft hearer. If to thefe late acquifitions, fo honourable to this Society, I add thofe in Natural Hiftory, by the zeal and unwearied attention of fome worthy members, who have extended your correffpondence and adorned your Mufeum; and by thofe other gentlemen, who, animated with a noble fpirit, have, to their lafting honour, undertaken the moft dangerous and moft diftant voyages in purfuit of Natural Knowledge: I fay, when to the progrefs you are making in Experimental Philofophy, I add that in the Hiftory of Nature, every true lover of fcience will rejoice to think, that your affairs have not, perhaps, at any period, been in a more flourishing condition.

Dr.

Dr. PRIESTLEY,

It is now time that, in the name and by the authority of the Royal Society of London, instituted for the improvement of Natural Knowledge, I present you with this medal, the palm and laurel of this Community; as a faithful and unfading testimonial of their regard, and of the just sense they have of your merit, and of the persevering industry with which you have promoted the views, and thereby the honour of this Society. And in their behalf I must earnestly request you, to continue those liberal and valuable inquiries, whether by further prosecuting this subject, probably not yet exhausted, or by investigating the nature of some other of the subtile fluids of the universe. You will remember, that *Fire*, the great instrument of the Chemists, is but little known even to themselves; and that it remains a *Query*, what was by the most celebrated of philosophers proposed as such, whether there be not a certain fluid (he calls it *Æther*)
the

the cause of gravity, the cause of the various attractions, and of the animal and vital motions [k]. These, Sir, are indeed large demands: but the Royal Society have hitherto been fortunate in their pneumatic researches. And were it otherwise, they have much to hope from men of your talents and application, and whose past labours have been crowned with so much success.

[k] Newton's Optics, Quer. 18—24.



E R R A T A.

Page.	Line.		
3.	19.	for <i>fire, and</i>	r. <i>fire; and they saw</i>
12.	5.	for <i>he</i>	r. Mr. LANE
20.	8.	for <i>nihil</i>	r. <i>nickel</i>
29.	2.	for <i>call</i>	r. <i>or call</i>